Technology Acceptance of Mobile Online Class Notes:

The Case of High School Students

Muhammet Furkan Taşel, Meltem Ozturan
Bogazici University, Department of MIS
Istanbul, Turkiye

Abstract— **In the last decades, there is a surge in the use of information and communication technology (ICT) in education. The study examines Turkish secondary students' adoption of mobile online class notes (MOCN) by analyzing survey responses and usage frequencies of 283 student users of a MOCN platform. A new model based on Venkatesh et al.'s Unified Theory of Acceptance and Use of Technology (UTAUT) is proposed to observe the medium's acceptance. Online content retrieval frequency data is pivoted against the intention to use the system to assess the user behavior. The variables performance expectancy, effort expectancy and habit were found to explain the intention to use the MOCN platform. Additionally, intention to use the platform is found to influence both the actual and perceive MOCN use. Variance in age and grade level influence the actual use but do not influence the perceived use. The study originally contributes to the literature by comparing self-declared use with the recorded use of MOCN in Turkish secondary education context and provides a basis for further research.**

Keywords—E-Learning; class notes; mobile; educational technology acceptance; secondary education; high school; adoption; Turkey; UTAUT; lecture notes

I. INTRODUCTION

Studies show that the utilization of information and communication technology positively impacts education [1, 2]. This particular use of technology has been around for a while. Noteworthy examples include Skinner's "teaching machines" of 1954, University of Illinois' PLATO, and the early mass open online course Open University [3]. In the last two decades, the globe has seen the internet's democratization with a convincing ascend of internet penetration [4]. The educational content on the internet was also changing during this ascend [5]. While the first examples were comprised of static content, with the introduction of Web 2.0, students gained the ability to engage with the content using interactive functionalities of the platform [5]. Mainstream adoption of smartphones facilitated the consumption of educational content of mobile devices. While using mobile devices for educational context is thoroughly researched, a study conducted in Qatar shows that using mobile phones in the classroom are only favored by some of the students [6].

II. LITERATURE REVIEW

Various methods have been developed to measure adoption of many emerging technologies. For instance, Fishbein and Ajzen [7] introduced the Theory of Reasoned Action (TRA), which was later extended to the Theory of Planned Behavior (TPB) [8]. Technology Acceptance Model (TAM) was influenced by these two models [9]. Venkatesh et al. [10] generalized TAM and introduced the Unified Theory of Acceptance and Use of Technology (UTAUT), which was extended by Venkatesh et al. [11] with the inclusion of more constructs under the name UTAUT2.

UTAUT model was used in education technology research priorly. Chen [12] examines of Taiwanese university students' adoption of e-learning platforms utilizing the UTAUT model. In broader research, Nistor et al. [13] works with an intra-national data set manifesting UTAUT's extensive validity. Recently, Altalhi et al. [14] founds the effect of the UTAUT factors performance expectancy, effort expectancy, social influence, self-efficacy attitude and facilitating conditions significant on 150 MOOCs' student's adoption of MOOCs in Saudi Arabia. This research examines the adoption of accession to the class notes on mobile devices using the UTAUT model.

Kucuk et al. [15] explores the trends in e-learning literature in Turkey from 1990 to 2011, with scanning 1151 journal articles written in indexed journals of Social Science Citation Index, Science Citation Index, and Education Resources Information Center. Educational technology articles of Turkey dominantly use quantitative methods and convenience sampling. The studies' emphasis is on higher education, and only 9.6% of the subjects of the studies are high school students.

Murray et al. [16] conducts a study to determine students' interaction with the online course content for a digital literacy course that consists of 92 online university level resources. 63% of the students accessed all of the online course content. When asked to students themselves, 78% of the students indicated frequent use (i.e., marked "always" and "usually" in the questionnaire) [16]. While this study does not specify any figures related to the access medium, it may be

assumed that it is a significant guide for measuring usage in mobile medium.

There are several studies related to mobile phone usage in the educational context. In one particular study, authors show that 629 out of 1082 university students use their phones for educational purposes [17]. Kuznekoff & Titsworth's study finds that class members who do not use their cell phones frequently for social media services and texting had more information stored on their paper when note-taking. Their notes were more detailed and organized [18]. Additionally, non-frequent texters/posters scored higher on the multiple-choice test compared to frequent texters/posters [18]. However, it's found that students with better academic standing are using their phones less than those with worse academic standing [17]. This raises the question of whether the negative correlation between note taking and mobile phone usage is due to the student's particular academic interest. On the other hand, in a study related to systematic review for mobile learning adoption, it is indicated that self-efficacy is the most frequent factor affecting the m-learning adoption [19].

III. RESEARCH MODEL AND HYPOTHESES

The research's main objective is to capture the usage behaviors of secondary students who study class notes from their mobile phones.

This research devises a model for measuring the adoption of accessors of MOCN using constructs drawn from UTAUT. It tests whether performance expectancy, effort expectancy, social influence, facilitating conditions, habit, and MOCN anxiety affect MOCN use intention using a survey supplied to the system's users. The relationship between the MOCN use intention and perceived MOCN use also inquired with the use of the questionnaire. While these are common questionings with UTAUT, the research tries to contribute to the literature with questioning whether perceived MOCN use is correlated with the actual access frequencies of the users which denoted as actual MOCN use. Additionally, demographic factors affecting both perceived MOCN use and actual MOCN use are inquired.

Based on the findings of the literature review and the research questions indicated above, the model proposed of the current study for perceived and actual use of MOCN can be seen in Fig. 1.

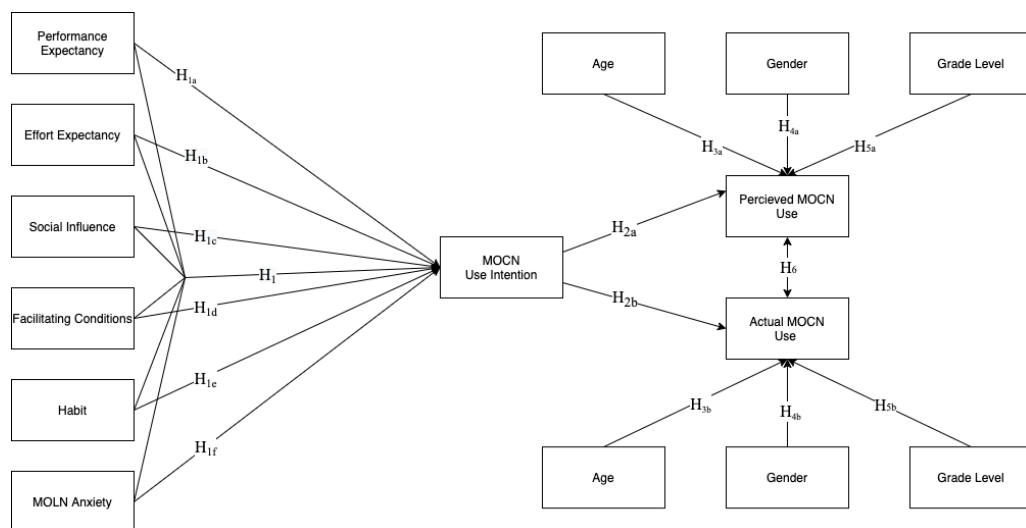Considering the model proposed, 16 hypotheses are developed as given below.

Fig. 1. *Model diagram for comparing survey data with perceived and actual use of MOCN*

H1a: Performance expectancy has a positive effect on behavioral intention to use.

H1b: Effort expectancy has a positive effect on behavioral intention to use.

H1c: Social influence has a positive effect on behavioral intention to use.

H1d: Facilitating conditions have a positive effect on behavioral intention to use.

H1e: Habit has a positive effect on behavioral intention to use.

H1f: MOCN anxiety has a positive effect on behavioral intention to use.

H1: Performance expectancy, effort expectancy, social influence, facilitating conditions and MOCN anxiety together behavioral intention to use.

H2a: MOCN use intention has a positive effect on perceived MOCN perceived usage.

H2b: MOCN use intention has a positive effect on perceived MOCN actual usage.

H3a: There is a significant difference on perceived MOCN usage for different age groups.

H3b: There is a significant difference on actual MOCN usage for different age groups.

H4a: There is a significant difference on perceived MOCN usage for different genders.

H4b: There is a significant difference on actual MOCN usage for different genders.

H5a: There is a significant difference on perceived MOCN usage for different grade levels.

H5b: There is a significant difference on actual MOCN usage for different grade levels.

H6: There is a correlation between perceived usage and real MOCN usage.

IV. METHODOLOGY

The research sample was chosen from a MOCN application namely, Lideno, which is a class notes platform with over 8,000 monthly active users. Lideno offers free access to class notes of the courses offered in the Turkish high school curriculum. Users of the MOCN application can download it from Apple App Store or Google Play Store. Notes are displayed according to the grade levels, subject names, and topic names. Users log in and are identified using their emails.

Since one of the research's objective is to capture the usage behaviors of secondary students who study class notes from their mobile phones, usage frequencies are gathered as a secondary data from the Lideno logs of users for five months.

A questionnaire was then developed for students to collect primary data for testing the study's model and hypotheses. The original UTAUT survey was adapted to focus on MOCN usage instead of general technology use. Constructs such as performance expectancy, effort expectancy, social influence, facilitating conditions, habit, and MOCN use intention were based on the questionnaire provided by Venkatesh et al. [11]. MOCN anxiety was measured using Venkatesh et al. [10]'s questionnaire. The construct for MOCN usage was created by combining questions from the surveys prepared by Ku [20] and Haghshenas et al. [21]. The questions drawn from these studies are translated to Turkish by the researcher. Then the questions are translated back to English to check whether the meaning is lost; this process is repeated until there is no difference in the meaning due to translation.

Lideno's home screen provided a link to the questionnaire composed of questions measured with a 5-point Likert scale. Students took the questionnaire hosted online on SurveyMonkey and were asked to state their degree of agreement or disagreement with the supplied statements on a scale of 5 (1-strongly disagree, 5-strongly agree). The questionnaire had 35 questions and two parts. Thirty-one of the questions were based on the scales adapted from the above mentioned questionnaires, while the remaining four were related to demographics as age, gender, high school type, and grade level.

Convenience sampling was chosen as the sampling method of the research. Students' e-mails were used as the pivot to connect primary data to secondary data. The participation was supported by reminding the users via mobile notifications. Follow-up e-mails were set up to increase the number of completed surveys.

A total of 613 participants took part in the survey. However, only responses with three or fewer missing questions were accepted, resulting in 501 complete responses. Responses without email information were excluded as they couldn't be linked to secondary data. This left 397 responses. Further exclusions were made for users who hadn't used the application in pre mentioned five months, weren't high school students, or were recent high school graduates, reducing the count to 293. Finally, outliers were removed using Mahalanobis' and Cook's distance values, yielding a final sample size of 283. The hypotheses were tested using regression, multiple regression, t-test and correlation analyses.

V. RESULTS

The hypotheses were tested using regression, multiple regression, t-test and correlation analyses.

SPSS is used for analyzing data. Missing values are eliminated. Scales that comprise the questionnaire are well tested before, yet a reliability analysis is performed to see if the scales can be united in a single questionnaire. Cronbach's Alpha values for all the variables were above or close to 0.7, which was found to be acceptable by Cortina [22] therefore all the variables are kept as it is.

A. Regression Analyses

Regression analyses show that:

- Performance expectancy explains 18% of the variance in MOCN use intention ($R^2 = 0.180$; $p<0.001$). Accordingly, H1a is accepted.

- Effort expectancy explains 20% of the variance in MOCN use intention ($R^2 = 0.203$; $p<0.001$). Accordingly, H1b is accepted.

- Social influence explains 13.8% of the variance in MOCN use intention ($R^2 = 0.138$; $p<0.001$). Accordingly, H1c is accepted.

- Facilitating conditions explain 13.4% of the variance in MOCN use intention ($R^2 = 0.134$; $p<0.001$). Accordingly, H1d is accepted.

- Habit explains 18.9% of the variance in MOCN use intention ($R^2 = 0.189$; $p<0.001$). Accordingly, H1e is accepted.

- MOCN anxiety does not predict MOCN use intention with $p = 0.196$. Accordingly hypothesis H1f is rejected.

- MOCN use intention explains 33.4% of the variance in perceived MOCN use ($R^2 = 0.334$; p<0.001). Accordingly, H2a is accepted.

- MOCN use intention explains 43.3% of the variance in actual MOCN use ($R^2 = 0.433$; p<0.001). Accordingly, H2a is accepted.

B. Multiple Regression Analysis for Factors Affecting MOCN Use Intention

Multiple regression technique ise used to measure factors performance expectancy, effort expectancy, social influence, facilitating conditions, habit, and MOCN anxiety's prediction of MOCN Use Intention. The independent variables explain 33.4% of the variation of MOCN Use Intention. The components of the regression social influence, MOCN anxiety, and facilitating conditions are not found significant while the rest of the variables are significant. The hypothesis is partially supported with F = 23.06 with p < 0.005. The regression equation is as follows:

MOCN Use Intention = 1.014 + 0.023 x Social Influence - 0.08 x MOCN Anxiety + 0.224 x Habit + 0.189 x Performance Expectancy + 0.235 x Effort Expectancy + 0.105 x Facilitating Conditions

C. T-test Analyses

T-test analyses for different groups show that:

- Equal variances should be assumed for the independent samples t-test used to compare means of age groups on perceived MOCN use (p > 0.05 in Levene's test) and H3a is rejected with t = 1.274 and p = 0.204.

- Equal variances should not be assumed for the independent samples t-test used to compare means of age groups on actual MOCN use (p < 0.05 in Levene's test) and H3b is accepted with t = 3.679 and p = 0.001.

- Equal variances should be assumed for the independent samples t-test used to compare means of gender groups on perceived MOCN use (p > 0.05 in Levene's test) and H4a is rejected with t = 0.477 and p = 0.634.

- Equal variances should not be assumed for the independent samples t-test used to compare means of gender groups on actual MOCN use (p < 0.05 in Levene's test) and H4b is rejected with t = -1.692 and p = 0.092.

- Equal variances should be assumed for the independent samples t-test used to compare means of grade level groups on perceived MOCN use (p > 0.05 in Levene's test) and H5a is rejected with t = 1.885 and p = 0.060.

- Equal variances should not be assumed for the independent samples t-test used to compare means of grade level groups on actual MOCN use (p < 0.05 in Levene's test) and H5b is accepted with t = 4.139 and p = 0.001.

D. Correlation Analyses between Perceived MOCN Use and Actual MOCN Use

Perceived MOCN use is correlated to the actual MOCN use with r = 0.351 and p < 0.002. The hypothesis H6 is and the correlation is found to be weak.

VI. DISCUSSION

The research tests 16 different hypotheses to thoroughly examine factors affecting the adoption of MOCN in Turkey in secondary education. All of the hypotheses are drawn from the literature and are supported by empirical evidence. In this section, the results of the hypotheses testings are discussed.

Each of the independent variables, performance expectancy, effort expectancy, social influence, facilitating conditions, and habit were found to predict the dependent variable MOCN use intention as the hypotheses H1a, H1b, H1c, H1d, and H1e are accepted. These relationships were expected as the UTAUT model is widely accepted in literature, and the research uses an adapted version of the scale provided by Venkatesh et al. [11]. Additionally, hypothesis H1 is partially supported with performance expectancy, effort expectancy, and habit significantly contribute to explain the regression model. The variables social influence, facilitating conditions, and MOCN anxiety do not significantly predict the multiple regression. Interestingly, both social influence and facilitating conditions linearly predict the MOCN use intention separately. While this is uncommon, a possible high correlation between the independent variables of the multiple regression might explain the behavior. Marginal contributions of performance expectancy, effort expectancy, and habit are higher than others in explaining the regression model.

According to Social Cognitive Theory (SCT), one of the underlying theories of UTAUT, computer anxiety is a determinant of use intention (Venkatesh et al. [10]). Computer anxiety was adapted as MOCN anxiety in this research as in this particular sample; the construct could have a direct influence on use intention. Nevertheless, the hypothesis H1f is rejected, and it is found out that MOCN anxiety has no significant effect on MOCN use intention. This goes parallel with the literature. Venkatesh et al. [10] highlights that the relationship between computer anxiety and behavioral intention is insignificant as computer anxiety construct's effect on intention is captured by effort expectancy.

Perceived MOCN use construct in the questionnaire was not based on a single scale but was drawn from two different scales, namely Ku [20] and Haghshenas et al. [21]. The remaining questions of the questionnaire were adapted from UTAUT's original survey.

Therefore, using this exact composition of questions is a distinct form of measuring the proposed model. H2a is accepted, and the significance of the

relationship between MOCN intention to use and perceived MOCN use shows that this exact set of questions could be tested further in the future.

The research examines the relationship between use intention and perceived MOCN use compares it to the relationship between use intention and actual MOCN use. The related hypotheses H2a and H2b were both accepted. These findings show that the declared use intention of the high school students who participated in the research is explains both self-declaration of the usage behavior and of its actual frequency of use. This is an original contribution of the current research to the literature. There was no priori study conducted in secondary education which included both perceived MOCN use and actual MOCN use constructs.

The research tests whether there are meaningful differences in variances according to demographics for both perceived MOCN use and actual MOCN use. There are no significant differences according to age, gender, and grade levels for perceived MOCN use construct as H3a, H4a and H5a were rejected. Similarly, there was not a significant difference amongst different genders for actual MOCN use as H4b is rejected. Interestingly, differences in age and grade level imply a difference for actual MOCN use according to ANOVA analysis performed while testing H3b and H5b.In further research, these two demographic groups might be united and examined accordingly.

The comparison of actual MOCN use to perceived MOCN use is one of the unique properties of this research. High school students of the MOCN platform Lideno's declaration of their usage behavior is found to be correlated to their actual usage of the platform as the related hypothesis H6 is also accepted. This result could provide a basis for further research.

VII. Limitations and Further Research

The research measures the adoption with the previous research's theoretical constructs by supplying a survey to the sample in question. While the model in question is well tested and widely accepted, usage information is currently based on personal reflections of the user and measurement of the accession frequencies using the frequency of GET requests of the server. An individual participant's declarations can be misleading; hence, is not the best way to measure the usage. Also, due to the platform's nature and accessible data, metrics like time spend on page while accessing the class notes, areas of user focus and tap frequencies on the note were not measured. While the time delta chosen for the accession logs is meaningful and helpful in eliminating potentially duplicate data, it might not measure churns or limited accession.

This study might not have shown the effect of COVID-19 pandemic since it didn't cover the whole pandemic period. It should not be forgotten that the COVID-19 pandemic disrupted teaching and learning worldwide, presenting a significant challenge to advancing and maintaining education during a crisis. Social distancing and measures taken in schools to avoid public health system failures both in Turkey and globally might have affected the student's behavior that were the subjects of the research. In this context, Maketo et al. [23] indicates that implementation of m-learning and ensuring continuity of quality in education should be one of the main education-related goals of the world. Further research should examine the short-term and long-term effects of COVID-19 in adopting e-learning platforms and MOCN platforms.

Research on educational technology in Turkey is promising; and articles in accepted global journals are frequently referencing the research. The number of papers on higher education and teacher education is currently dominating other research areas such as educational technology at the high school level.

While this research is not the first piece in educational technology in Turkey, the research in particular focus area "Online Class Notes Accession in Mobile Devices" is limited. This research poses a starting point for further research on assessing the utility of the online class notes reached in differing mediums. New devices or technologies emerge other than mobile phones and accessing course content on the new technologies should be considered a research topic.

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